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FIRST RECORDS OF ERYTHRAEIDAE PARASITIC ON ORIBATID MITES (ACARI, PROSTIGMATA: ACARI, ORIBATIDA)

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Abstract.—Larvae of two undescribed species of the mite genus *Leptus* (Erythraeidae) were found attached to the heavily sclerotized cuticle of ten oribatid mites, representing four species and three families. Parasitized mites, each carrying a single *Leptus* larva, were collected from forest soils in Massachusetts, Mississippi, and Alabama. This is the first reported association between these taxa, but the specificity of the relationship is unknown.

Key Words: *Leptus*, ectoparasites, oribatid mites

Oribatid mites, most of which are saprophagous or fungivorous inhabitants of soil organic horizons, commonly serve as hosts for a variety of parasitic and commensal organisms. From the early work of Nicolet (1855) to the detailed studies of K. Purrini and colleagues (e.g. Purrini 1980), we have learned that these mites are parasitized by bacteria, fungi, virus-like organisms, various protozoans (amoebae, eugregarines, microsporidians, helicosporidians), and nematodes. Their servitude as intermediate hosts for anoplocephalid tapeworms is perhaps the most widely known parasitic relationship (see review by Sengbusch 1977). Records of commensal associations are fewer. Phoretic transport of nematodes (e.g. Travé 1956) or deutonymphs of the mite suborder Astigmata is not uncommon (unpublished obervations, R.A.N.), but is rarely reported. Ciliate protozoans, apparently related to Conidiophryidae and similar to those carried by soil-dwelling mesostigmatic mites (Dindal 1973), are also commonly attached to leg or body setae of oribatid mites (unpublished observations, R.A.N.); they are probably commensals.

To this list of relationships we can now add ectoparasitism by mites of the family Erythraeidae. These mites are protelean ectoparasites whose larvae utilize a wide variety of insect and arachnid hosts (Welbourn 1983 and included references), and whose deutonymphs and adults are free-living predators. Their red color and wide host range make them the most obvious of terrestrial protelean parasites.

METHODS AND RESULTS

From three different localities we observed multiple cases of parasitism by larvae of the erythraeid genus *Leptus* on adult oribatid mites which had been extracted by Berlese funnels from forest soil and litter. Each of four specimens of *Oribatella extensa* Jacot (Oribatellidae) from Mississippi (kudzu litter, Ecru, Pontotoc Co., 18-III-

1981, R. L. Brown, col.) carried a single *Leptus* larva attached dorsally on the posterior half of its notogaster (Figs. 1, 2). Four specimens of *Damaeus verticillipes* (Nicolet) (Damaeidae) from Massachusetts (white pine plantation litter, Babson College campus, Wellesley, Norfolk Co., 6-XI-1985, J. R. Philips, col.) also carried a single *Leptus* each. In three cases the larva was attached to the notogaster, behind the stacked exuvial scalps which this species usually carries (Figs. 3, 4); in one case attachment was on the ventral plate, immediately posteriad of the anus, but the general posture of the larva was as in Fig. 3. In the third collection, from Alabama (forest litter, Conecuh Co., 0.2 mi. W of junction of Sepulga River and Rt. I-65, 15-III-1986, R. D. Cave, col.), one specimen each of *Xenillus occultus* Banks (Xenillidae) and *Damaeus grossmani* Wilson (Damaeidae) carried a *Leptus* larva. In the former case, the parasite was positioned near the notogastral margin, midway along its left side; in the latter, attachment was similar to that of Fig. 1, but on the right side. None of the attached *Leptus* larvae were engorged when collected.

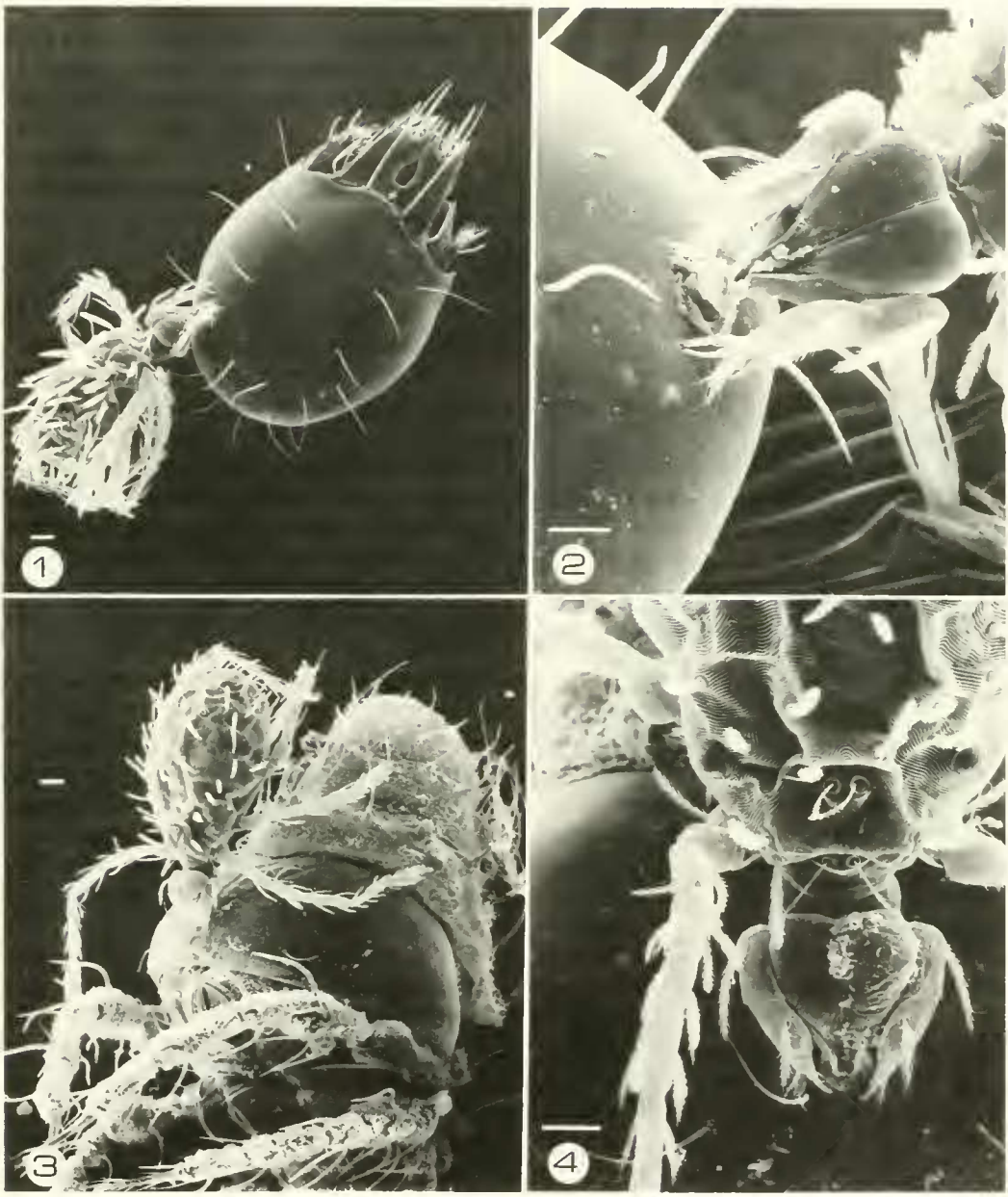
The host mites from Massachusetts were observed alive for one week to compare their behavior with that of non-parasitized individuals. Despite the relatively large size and sometimes non-axial positioning of the parasite (Fig. 1), the oribatid hosts were quite mobile, and showed no abnormal activity. Noticeable engorgement did not take place during this time. Although not observed alive, the oribatid mite hosts from the other two collections must have been active enough to respond to increasing desiccation and move through the litter column in the Berlese extractor.

Discussion

These examples illustrate the ability of *Leptus* larvae to attach almost anywhere on an arthropod integument. Whereas other erythraeid larvae, with short cheliceral bases, tend to attach along molting sutures (Young and Welbourn 1987), *Leptus* larvae have long, flask-shaped cheliceral bases (Baker 1982, Southcott 1961, Treat 1975) which facilitate the penetration of even well sclerotized cuticle, such as the notogaster of oribatid mites. Baker (1982) reported a "viscous substance" that was secreted just prior to attachment of *Leptus* larvae, and suggested that upon hardening it formed a cement which secured the mite to the host. It can be seen in Fig. 2, where the gnathosoma contacts the oribatid mite cuticle. Although the material seems to play a role in attachment (no stylostome is formed), it also forms a seal around the feeding lesion (Åbro 1988). In contrast to other erythraeid larvae, the gnathosoma of *Leptus* species lacks the buccal fringe or ring which usually performs the latter function (unpublished observations, W.C.W.).

Systematic studies of *Leptus*, which includes nearly 90 named species worldwide, have concentrated on the larval instar (e.g. Southcott 1961, Beron 1975, Fain and Elsen 1987, Fain et al. 1987). The American fauna is still poorly known, and all of the larvae from the oribatid mites represent undescribed species whose degree of host specificity is unknown. The *Leptus* larvae from Alabama and Mississippi are conspecific, and their occurrence on representatives of three oribatid genera, from three distinct families of Brachypylina, suggests little host specificity. Yet, no other parasitized arthropods were observed in the Mississippi sample, despite the presence of unattached *Leptus* larvae and numerous potential arthropod hosts (including other taxa of oribatid mites). Similarly, unattached larvae of the Massachusetts *Leptus* (representing a second undescribed species) were found in the original sample, but only individuals of *D. verticillipes* were parasitized.

Can a *Leptus* larva complete its development to a free-living deutonymph using a single oribatid mite host? We have no evidence at present, since no observed specimen had started to engorge. If we speculate



Figs. 1–4. *Leptus* larvae parasitizing adult oribatid mites. Fig. 1. *Oribatella extensa* Jacot, from Mississippi (dorsal aspect), with *Leptus* sp. larva attached to notogaster. Fig. 2. As in Fig. 1, except dorsolateral aspect. Note hardened "cementing" material at point of attachment. Fig. 3. *Damaeus verticillipes* (Nicolet), from Massachusetts (posterolateral aspect), with *Leptus* sp. larva attached to notogaster. Fig. 4. As in Fig. 3, except posterior aspect. All scanning electron micrographs; scale bars on Figs. 1 and 3 represent 45 μm, those on Figs. 2 and 4 represent 25 μm.

that it can, the parasitism would probably be lethal to the host, considering the relative size of the two mites. This would be consistent with the absence from the samples of hosts with engorged parasites, since decreased mobility in the Berlese funnels would be expected once engorgement begins; it would also be consistent with the absence of oribatid mites having noticeable lesions resulting from prior parasitism.

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